Space Weather Technical Forecast

Issued on Thursday 30 January 2025 at 00:34 Local

This technical forecast provides a four-day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

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Space Weather Forecast Headline: Chance of isolated M-class flares. G1 minor geomagnetic storms likely 31 Jan with HSS connection.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Activity has been Moderate, with one M-class flare in the last 24 hours, peaking at a M1.0 recorded at 29/0408 UTC, and originating from AR3977

There are currently five sunspot regions visible on the Earth-facing side of the Sun. AR3976, AR3977 and AR3978 have recently emerged from the north-eastern limb and represent the bulk of current activity and magnetic complexity, warranting further analysis as they move onto the solar disc. The remaining sunspots are small and magnetically simple although a new, as yet unnumbered region has developed near centre disk and will be monitored.

No Earth-directed CMEs have been observed in the last 24 hours.

Solar Wind / Geomagnetic Activity: The solar wind, as measured by ACE/DSCOVR at L1, was at generally background levels, ranging from 280-360km/s with some weak CME influence possible. Density was average or just below. The Interplanetary Magnetic Field, Bt, was mostly weak, but peaked at near 10nT. The north-south component, Bz, mostly varied weakly between +/-7nT. The phi angle fluctuated but was mostly positive (Away from the Sun). Geomagnetic activity was Quiet (Kp0-2).

Energetic Particles / Solar Radiation: High energy proton flux at GOES18 was at background levels.

High energy electron flux (greater than 2MeV) at GOES16 was at background to moderate levels. The associated 24-hour fluence persisted below the Active threshold, recording 1.28e6 integrated pfu at 30/0000UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Low to moderate solar activity is expected, with a chance of isolated M-class flares and a very slight chance of isolated X-class flares, primarily from regions in the northeast of the solar disc.

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Solar Wind / Geomagnetic Activity: No Earth-directed CMEs currently feature in the forecast, with the outlook dominated by the large recurrent coronal hole, CH11/+, near centre disk. This feature is expected to bring an increases of solar winds from current background levels towards elevated or strong levels, 550-650km/s, from later Day 1 (30 Jan) or more likely through Day 2 (31 Jan).

Generally Quiet activity (Kp1-2) expected initially. Activity expected to increase to become generally Unsettled to Active (Kp3-4) from late Day 2 (30 Jan) onwards, with the slight chance of G1 minor storm intervals increasing to a likelihood on Days 2-3 (31 Jan - 01 Feb) with the expected connection to CH11/+.

Energetic Particles / Solar Radiation: GOES18 high energy proton flux is at background levels, with only a very slight chance of rising in response to any notable flares.

GOES16 high energy electron flux is expected to remain at background to moderate levels. The corresponding 24-hour fluence is expected to remain below the Active threshold on a declining trend.

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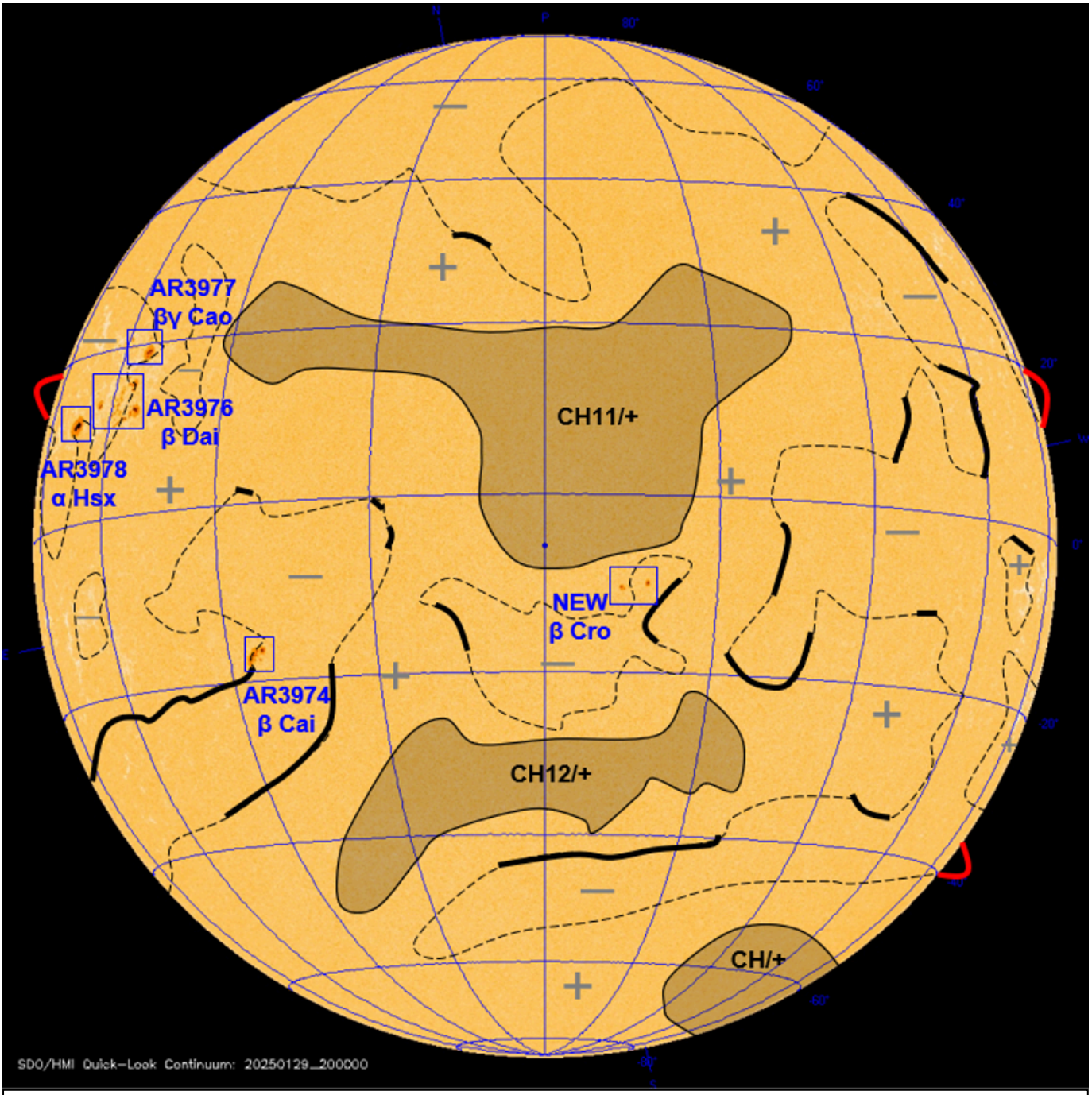
Figure 1: Solar Synoptic Map valid 29/2000UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms

No Earth-directed CMEs currently feature in the forecast, with the outlook dominated by the large recurrent coronal hole, CH11/+, near centre disk. This feature is expected to bring an increase of solar winds from current background levels towards elevated or strong levels, 550-650km/s, from later Day 1 (30 Jan) or more likely through Day 2 (31 Jan). This is supported from both recurrence and MOSWOC ENLIL model output - albeit MOSWOC ENLIL is believed too be currently bringing in these fast winds too quickly. Solar wind speeds are then expected to remain at elevated or strong levels through Day 3 and 4 (01 - 02 Feb), but on a slow declining trend, perhaps falling to slightly elevated levels by the end of Day 4.

Generally Quiet activity (Kp1-2) expected initially. Activity expected to increase to become generally Unsettled to Active (Kp3-4) from late Day 1 (30 Jan) onwards, with the slight chance of G1 minor storm intervals increasing to a likelihood on Days 2-3 (31 Jan - 01 Feb) with the expected connection to CH11/+.

Geomagnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	20	60	50	20
Strong	G3	No	1	5	2	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Figure 2: Persistence forecast showing expected connection to fast winds through the 31 Jan.

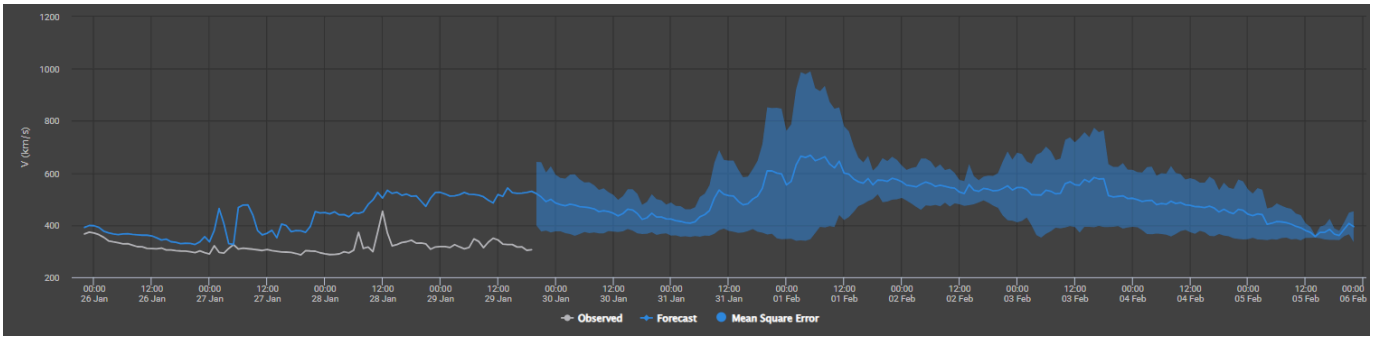

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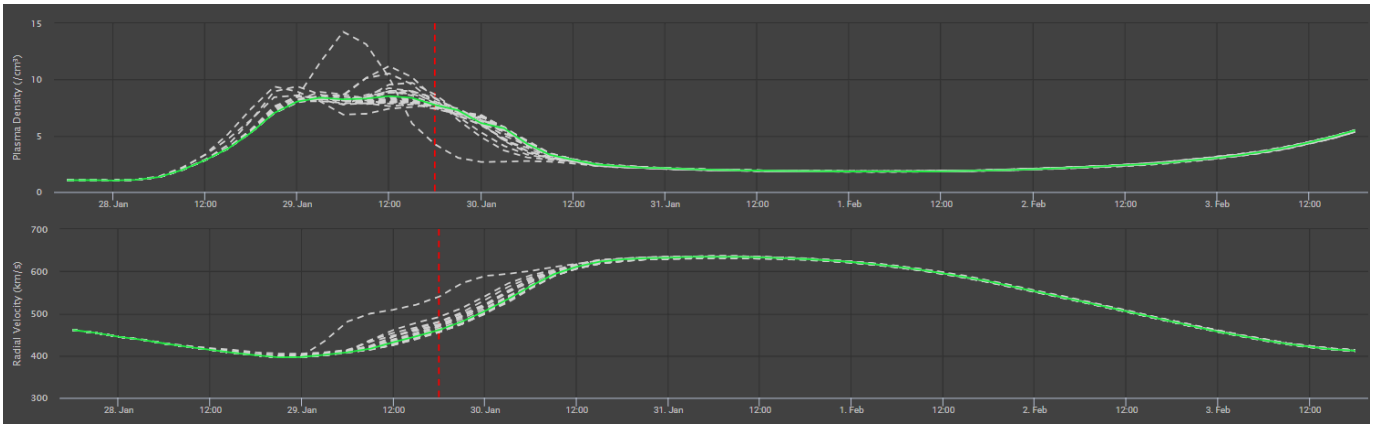
Figure 3: Latest MOSWOC ENLIL ensembles output, HSS clearly visible in output, but viewed as likely somewhat too early to increase solar winds.



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Radio Blackouts - X-Ray Flares

Solar activity has been Moderate, with one M-class flare in the last 24 hours, peaking at a M1.0 recorded at 29/0408 UTC, and originating from AR3977.

There are currently five sunspot regions visible on the Earth-facing side of the Sun. AR3976, AR3977 and AR3978 have recently emerged from the north-eastern limb and represent the bulk of current activity and magnetic complexity, warranting further analysis as they move onto the solar disc. The remaining sunspots are small and magnetically simple although a new, as yet unnumbered region has developed near centre disk and will be monitored.

Overall, the daily flare risk is kept steady over the coming days pending further developments, somewhat below the average level. Generally Low to Moderate solar activity is expected with a chance of isolated M-class flares and a slight chance of isolated X-class flares, primarily from regions in the northeast of the solar disc.

X-Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 (M Class)	Yes	40	40	40	40
Very Active	R3-R5 (X Class)	No	5	5	5	5

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Solar Radiation Storms (High Energy Protons)

Proton flux is currently at background levels, and expected to remain so in the absence of significant solar flaring from the western hemisphere.

Radiation Storms Probability (Exceedance)	Level ($cm^{-2}sr^{-1}s^{-1}$)	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	5	5	5	5
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and/or 50 MeV ≥ 10pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

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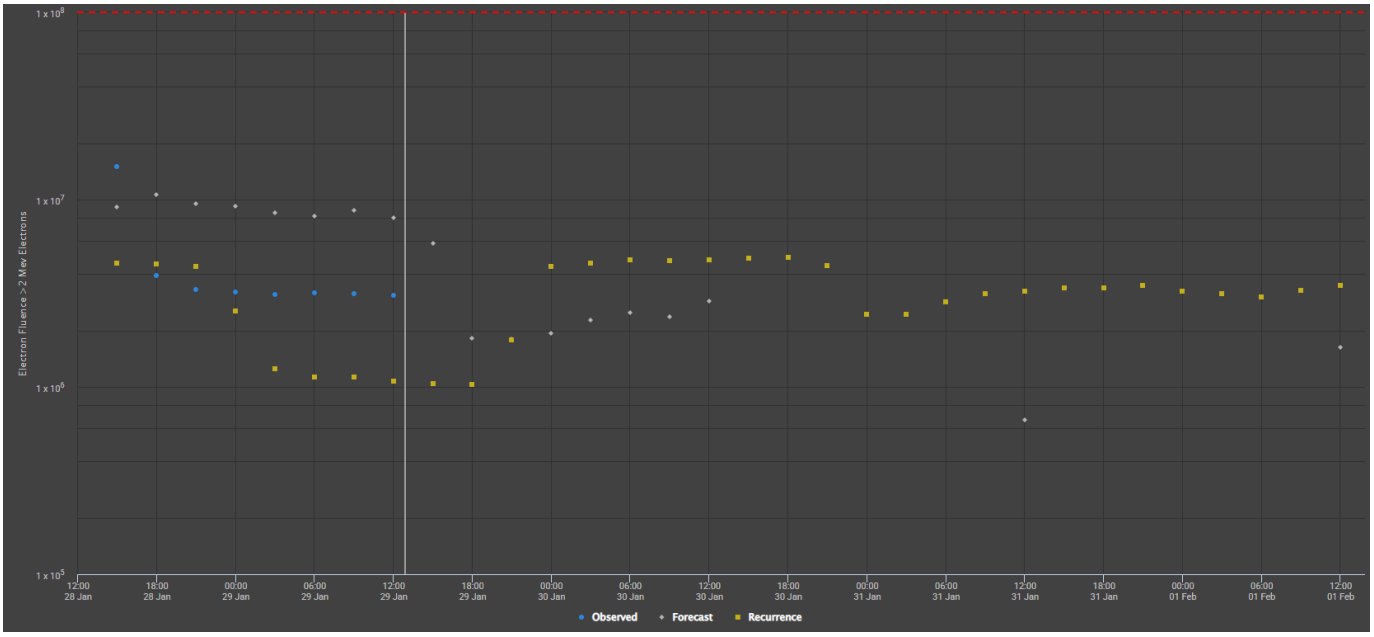
High Energy Electrons (≥ 2MeV)

High energy electron flux observed at GOES16 has been at background to moderate levels over the past 24 hours. Flux levels are expected to remain at similar levels through the forecast period.

The corresponding 24-hour fluence is expected to remain below the Active threshold, with a gradual downward trend. MOSWOC REFM is felt to be giving reasonable guidance.

GEO Electron Environment	Level ($cm^{-2}sr^{-1}$ day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ 2 MeV ≥ 1×10^{8}	No	1	1	1	1
Very Active	≥ 2 MeV ≥ 1×10^{9}	No	1	1	1	1

Figure 4: Latest MOSWOC REFM output.



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